

Article 8 Specifications for Hydrogen Used in Internal Combustion Engines and Fuel Cells

**4180. Definitions Used in This Article**

- (a) “Fuel Cell” means an electrochemical device used to convert hydrogen and oxygen into electrical energy to power a motor vehicle.
- (b) “Internal Combustion Engine” means a device used to ignite hydrogen in a confined space to create mechanical energy to power a motor vehicle.
- (c) “Hydrogen Fuel” means a fuel composed of the chemical hydrogen intended for consumption in an internal combustion engine or fuel cell.

**4181. Specifications – Hydrogen Fuel Used in Fuel Cells and Internal Combustion Engines.** No person shall sell, offer for sale, supply or offer for supply hydrogen fuel that fails to comply with the following standards:

Specification	Value	Test Method <sup>(a)</sup>
Hydrogen Fuel Index (minimum, %)	99.99	(b)
Total Gases (maximum, ppm v/v)	100	(c)
Water (maximum, ppm v/v)	5	ASTM D 6348
Total Hydrocarbons (maximum, ppm v/v) (d)	2	ASTM D 1946
Oxygen (maximum, ppm v/v)	5	ASTM D 5466
Helium (maximum, ppm v/v)	100	ASTM D 1946
Nitrogen and Argon (maximum, ppm v/v)	100	ASTM D 5466
Carbon dioxide (maximum, ppm v/v)	2	ASTM D 5466
Carbon monoxide (maximum, ppm v/v)	0.2	ASTM D 5466
Total Sulfur Compounds (maximum, ppm v/v)	0.004	ASTM D 5504
Formaldehyde (maximum, ppm v/v)	0.01	ASTM D 1946
Formic acid (maximum, ppm v/v)	0.2	ASTM D 1946
Ammonia (maximum, ppm v/v)	0.1	ASTM D 5466
Total Halogenated Compounds (maximum, ppm v/v)	0.05	ASTM D 5466
Particulates Size (maximum, µm)	10	SCAQMD Method 301-91
Particulate Concentration (maximum, µg/L @ NTP)	1	Gravimetric Determination EPA IO 3.1

- a. Modified or alternate test methods may be used provided they have been demonstrated to have a detection level and accuracy equal or better than the method specified.
- b. The hydrogen fuel index is the value obtained with the value of total gases (%) is subtracted from 100%
- c. Total Gases = Sum of all impurities listed on the table except particulates
- d. Total Hydrocarbons may exceed 2 ppm v/v only due to the presence of methane, provided that the total gases do not exceed 100 ppm v/v.

**4182. Sampling – Hydrogen Fuel.** The containers and procedures used to obtain hydrogen fuel samples are not specified. However, the equipment and techniques used must have been demonstrated to provide representative samples. The effectiveness of cleaning procedures for sampling equipment and containers shall be confirmed by analyzing ultra high purity hydrogen. The determined concentration of each contaminate measured shall be equal or less than one fifth (1/5) of the specified limit in Section 4181.